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EXAMINER

MUTSCHLER, BRIAN L

ART UNIT PAPER NUMBER

1753

DATE MAILED: 04/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/855,059

Applicant(s)

BASOL ET AL.

Examiner

Brian L. Mutschler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-45, 57-61 and 63-66 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3, 13 and 26 is/are allowed.
- 6) ☐ Claim(s) 1, 2, 4-12, 14-25, 27-45, 57-61 and 63-66 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 March 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Comments

1. The objections to the specification and the title have been overcome by Applicant's amendment.
2. The rejection of claims 7-45 and 57-61 under 35 U.S.C. 112, second paragraph, has been overcome by Applicant's amendment, which more clearly defines the structure of the claimed device.

Drawings

3. The corrected or substitute drawings were received on March 25, 2003. These drawings are acceptable.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 4-9, 11, 12, 14 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Galik (U.S. Pat. No. 4,678,545).

Regarding claims 1 and 7, Galik discloses an apparatus for electroplating a circuit board comprising anodes **44** contacting the electrolyte **36** (fig. 8). The circuit board has a mask with a plurality of openings defining the areas to be plated (col. 2,

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lines 23-49). Conductive mesh screens **46** are positioned between the anodes **44** and wafer **32** (fig. 8; col. 5, lines 35-44). The screens **46** are connected to a power source (fig. 8).

Regarding claims 4 and 9, the conductive mesh screens **46** are shown having two areas electrically isolated from one another (fig. 8).

Regarding claims 5, 6 and 12, the power to each screen **46** is separately regulated and variable (fig. 8; col. 6, lines 18-52).

Regarding claim 8, the conductive element is a conductive mesh screen **46** (col. 5, lines 35-44).

Regarding claim 11, the screens **46** are separated by a gap (fig. 8).

Regarding claim 14, the screens **46** are positioned between the anodes **44** and the wafer **32** (fig. 8).

Regarding claim 19, the screens **46** are in the shape of strips (fig. 6; col. 5, lines 35-44).

Since Galik teaches the limitations recited in the instant claims, the reference is deemed to be anticipatory.

6. Claims 7-11, 19 and 64 are rejected under 35 U.S.C. 102(b) as being anticipated by Geels (U.S. Pat. No. 4,643,816).

Regarding claim 7, Geels discloses a plating apparatus comprising anodes **16**, **16'** contacting the electrolyte **14** (fig. 1). A shroud (mask) **20** having openings is disposed between the workpiece to be plated **18** and the anodes **16**, **16'** (fig. 1).

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Conductive elements **35, 35'** are disposed at the ends of the shroud **20** (fig. 1; col. 3, lines 39-57).

Regarding claim 8, the conductive elements **35, 35'** comprise screens of electrically conductive material (col. 3, lines 46-50).

Regarding claim 9, Geels discloses a plurality of electrically isolated screens **35, 35'** (fig. 1).

Regarding claim 10, the screens **35, 35'** are separated by the electrically isolating shroud, which is made of a non-conductive material (col. 3, lines 32-33).

Regarding claim 11, a gap separates the screens **35, 35'** (fig. 1).

Regarding claim 19, the screens **35, 35'** are in the form of strips (fig. 1).

Regarding claim 64, the conductive element **35** is "affixed directly" to the shroud **20** (fig. 1; col. 3, lines 52-57).

Since Geels teaches the limitations recited in the instant claims, the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 4-12, 19-25, 27, 32-45 and 57-61 rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687).

Regarding claims 1, 7, 8, 20, 21, 27, 57 and 58, Stone discloses an apparatus for plating wafers comprising a plurality of anodes **22A**, **22B** contacting the electrolyte **21** (fig. 2). Between the wafer **26** and the anodes **22A**, **22B**, shields are disposed (fig. 2). In one embodiment, the shield is a conductive mesh **40** connected to a power supply in such a way that the output is variable (fig. 2; col. 6, lines 35-62). The cathode assembly **26** is movable (col. 5, lines 23-27).

Regarding claims 4, 9, 22 and 59, Stone teaches that the two shields may be any of the disclosed shields, such as two of the conductive mesh shields (col. 5, lines 61-65).

Regarding claims 5, 6, 12, 25, 33, 36, 39, 40 and 43, each screen **40** is charged with a voltage by a voltage source (col. 6, lines 45-54). According to Stone, "the applied voltage magnitude is variable...and the power may be provided from any voltage source" (col. 6, lines 55-62).

Regarding claims 10, 23 and 60, the frames **52** containing the charged screens **40** are attached to a glide bar **32** (col. 6, lines 35-44). Since only the screens **40** are charged, it would be inherent that either the frame **52** or other supporting member would be electrically isolating.

Regarding claims 11, 24 and 61, the two shields are separated by a gap (fig. 2).

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Regarding claims 19 and 32, the screens **40** have the form of strips (fig. 5).

Regarding claims 34, 35, 37, 38, 41, 42, **44** and 45, Stone discloses that the charged screens **40** can either accelerate or decelerate the flow of ions (col. 7, lines 7-26).

The plating apparatus disclosed by Stone differs from the instant invention because Stone does not disclose the following:

- a. A mask with openings, as recited in claims 1, 7, 20 and 57; and
- b. The power sources and additional power sources, as recited in claims 5, 6, 12, 25, 33, 36, 39, **40** and 43.

Regarding claims 1, 7, 20 and 57, Edelstein discloses a baffle to modulate the cross-sectional distribution of flow rate in electrodeposition apparatuses. The baffle (mask) is comprised of two non-conducting plates **10, 12** having a plurality of holes **14, 16** that control the cross-sectional flow of the electrolyte by rotating the plates **10, 12** in relation to one another (fig. 1 and 3A-3C). Controlling the cross-sectional flow distribution of the electrolyte allows for the cross-sectional thickness of the deposited layer to be controlled according to the placement and orientation of the holes (fig. 8, 10 and 12).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the shield in the plating apparatus of Stone to use a baffle as taught by Edelstein because the baffle allows the cross-sectional flow distribution of the electrolyte to be controlled, which regulates the cross-sectional thickness of the deposited layer.

Regarding claims 5, 6, 12, 25, 33, 36, 39, 40 and 43, Stone discloses, "the power may be provided from any voltage source" (col. 6, lines 55-62). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the power source of Stone to use separate power sources or common power sources because Stone teaches that "any voltage source" can be used and the selection of a power source is dependent on the desired result of the system.

Regarding the intended use of the apparatus, i.e., electrodepositing or electroetching, the same apparatus can be used for both processes. To switch from electrodepositing to electroetching, the polarity of the cathode and anode is switched.

9. Claims 2 and 63-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687), as applied above to 1, 4-12, 19-25, 27, 32-45 and 57-61, and further in view of Geels (U.S. Pat. No. 4,643,816).

Stone and Edelstein describe a plating apparatus having the limitations recited in claims 1, 4-12, 19-25, 27, 32-45 and 57-61 of the instant invention, as explained above in section 8.

The apparatus described by Stone and Edelstein differs from the instant invention because they do not disclose the conductive mesh attached to the surface of the mask.

Geels discloses a plating apparatus comprising a shroud (mask) **20** having conductive elements **35, 35'** disposed at the ends of the shroud **20** (fig. 1; col. 3, lines 39-57). The conductive elements **35, 35'** comprise screens of electrically conductive material (col. 3, lines 46-50). The screens **35, 35'** are attached at the end of the shroud **20** to "[provide] a surface over which the electrical potential is substantially uniform, making the potential difference between points on the cathode-workpiece and points on the [screen] as uniform as possible" making the current more uniform (col. 3, lines 50-57).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive mesh in the apparatus described by Stone and Edelstein to affix the conductive mesh directly to the mask as taught by Geels because affixing the mesh directly to the mask provides a more uniform potential, resulting in a more uniform coating.

10. Claims 15-18 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687), as applied above to 1, 4-12, 19-25, 27, 32-45 and 57-61, and further in view

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of Tzanavaras et al. (U.S. Pat. No. 5,421,987), Uzoh (U.S. Pat. No. 6,071,388) and Hanson et al. (U.S. Pat. No. 6,139,703).

Stone and Edelstein describe a plating apparatus having the limitations recited in claims 1, 4-12, 19-25, 27, 32-45 and 57-61 of the instant invention, as explained above in section 8.

The apparatus described by Stone and Edelstein differs from the instant invention because they do not disclose the following:

- a. One of the isolated sections of the conductive element circumferentially surrounds another of the electrically isolated sections, as recited in claims 15 and 28;
- b. The electrically isolated sections of the conductive element are irregularly shaped, as recited in claims 16 and 29;
- c. One of the electrically isolated sections of the conductive element is ring-shaped, as recited in claims 17 and 30; and
- d. The other of the electrically isolated sections is disc-shaped, as recited in claims 18 and 31.

Regarding claims 15-18 and 28-31, Tzanavaras et al. disclose a plating apparatus comprising bias rings **40** and collimating screens (masks) **34** to control the thickness and uniformity of the deposited layer (col. 5, line 46 to col. 6, line 2; col. 6, lines 52-62). The bias rings **40** are designed to "divert excessive current density away

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from [the edges and corners of the substrate]" (col. 5, lines 61-67). For square substrates **42**, bias ring **40A** has an irregular shape; for circular substrates **42**, bias ring **40B** is ring-shaped (fig. 2(a) and 2(b)).

Uzoh teaches the use of similar rings **40** that act as auxiliary electrodes to control the deposition around the edges of the workpiece **16** (col. 5, lines 23-45). The auxiliary electrodes **40** are made of conductive mesh and can be placed coplanar with the workpiece **16** (as shown in Tzanavaras et al.) or the auxiliary electrode **40** may be "non-coplanar as may be required for a particular electroplating operation" (col. 6, lines 48-63).

Hanson et al. teach the use of a plurality of auxiliary electrodes **130**, wherein each segment **130** has a separately controlled voltage to control the deposited layer (fig. 2; col. 4, lines 3-27). Having a plurality of individually controllable segments allows the deposition to be more precisely controlled.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive mesh screen in the apparatus described by Stone and Edelstein to use a bias ring or auxiliary electrode as taught by Tzanavaras et al. and Uzoh because the bias ring/auxiliary electrode enables excess current to be diverted away from the edges and corners of the substrates for different sized substrates. Furthermore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a mesh screen as taught by Uzoh because using mesh allows the auxiliary electrode to be positioned coplanar or

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non-coplanar to the substrate because the mesh permits the flow of electrolyte through its openings.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive elements in the apparatus described by Stone and Edelstein to be irregularly shaped, ring-shaped or disc-shaped as disclosed by Tzanavaras et al. because Tzanavaras et al. teach that the shape of the bias ring should be designed such that the current density is uniform for the substrate, which requires irregular shapes for polygon-shaped substrates and disc or ring shapes for circular and rounded substrates.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive elements in the apparatus described by Stone and Edelstein to use a conductive element comprised of a plurality of cooperative segments as taught by Hanson et al. because a greater number of individually controlled segments allows more precise control of the current density.

Allowable Subject Matter

11. Claims 3, 13 and 26 are allowable over the prior art of record.
12. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or suggest the formation of a conductive mesh sandwiched by two mask layers. This feature of the instant invention allows the

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current density to be controlled by a single controlling member. The prior art, e.g., Galik (U.S. Pat. No. 4,678,545), discloses separate masks and conductive elements.

Response to Arguments

13. Applicant's response to the Office action mailed October 25, 2003, has been carefully considered, but is not persuasive.

14. Regarding the rejection of independent claims 1, 7, 20 and 57, in light of the limitation "the present invention as specified includes a conductive mesh (claim 1) or element (claims 7, 20, and 57) having a plurality of active regions defined by mask openings", Applicant has argued, "No such system, anode assembly, or apparatus is disclosed by U.S. Patent 4,678,545 to Galik, U.S. Patent 4,643,816 to Geels, U.S. Patent 6,132,583 to Stone, U.S. Patent 6,106,687 to Edelstein, or any of the other patent documents relied on by the Examiner" (see page 20 of Applicant's response).

15. This argument is not persuasive. As indicated in the prior Office action, Galik teaches, "The circuit board has a mask with a plurality of openings defining the areas to be plated (col. 2, lines 23-49)", wherein a plurality of active areas are formed at each of the plurality of openings in the mask. Geels teaches, "A shroud (mask) **20** having openings is disposed between the workpiece to be plated **18** and the anodes **16**, **16'** (fig. 1)", wherein two active areas are formed, one at each of the conductive elements **35** and **35'** (see Figure 1). Stone discloses controlling the flow of electrolyte through the use of a plastic screen **38** or controlling the flow of ions through the use of a conductive

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element **40** (US '583 col. 5, lines 66 to col. 6, line 5). Finally, as explained in the prior Office action, "Edelstein discloses a baffle to modulate the cross-sectional distribution of flow rate in electrodeposition apparatuses. The baffle (mask) is comprised of two non-conducting plates **10, 12** having a plurality of holes **14, 16** that control the cross-sectional flow of the electrolyte by rotating the plates **10, 12** in relation to one another (fig. 1 and 3A-3C)." The combination of Stone and Edelstein provides a device having a plurality of active areas formed by the shield of Stone and the baffle of Edelstein, which act together to control the flow of the electrolyte. As explained above and in the prior Office action, each of the references provides the structural limitations recited in the instant claims.

16. Regarding the reference of Galik, Applicant states, "It is to be particularly noted that, in the method of forming the subject matter of the Galik patent, both sides of a workpiece are plated...[and t]he mask referred to is an insulating layer, with holes, and the mask is on the substrate" (see page 20 of Applicant's response). While Applicants' observations are correct, Galik teaches all of the structural limitations recited in the instant claims. The mask recited in claim 1 of the instant application is not distinguished in any way from the insulating layer of Galik which is used as a mask to prevent plating in unwanted areas.

17. Regarding Geels, Applicant states, "no potential is applied to the screens 35, 35', and on each side of the cathode-workpiece 18, only one opening is provided" (see page 20 of Applicant response). This statement is also correct. However, it is noted that

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Applicant has not claimed a potential being applied to the conductive element.

Therefore, the conductive element of Geels teaches all of the limitations recited in the instant claims. Furthermore, as Applicant has stated, on each side of the workpiece, one opening is provided, which results in a total of two openings, which defines a plurality of active areas.

18. Regarding claim 2, Applicant has stated, "The Geels et al. patent disclosure does not suggest attaching a conductive mesh or element to a mask in the context of any structure which could result in combining the Stone and Edelstein disclosures as proposed by the Examiner" (see page 21 of Applicant's response). This argument is not persuasive. As explained above and in the prior Office action, Geels teaches, "This screen **35** is affixed directly to the second open end **24** of the box **22**" (col. 3, lines 50-51). As shown in Figure 1, the box **22** is a part of the shroud **20**. In lines 52-57 of column 3, Geels further teaches, "The false anode **35** provides a surface over which the electrical potential is substantially uniform, making the potential difference between the points on the cathode-workpiece and points on the false anode as uniform as possible. Thus, the current between the false anode is made to be more uniform." By attaching the screen **35** directly to the shroud **20** the device of Geels ensures that the electrolyte reaching the substrate passes through screen **35** and the shroud **20**, which makes the potential and current uniform. From the teachings of Geels, it would have been obvious to one skilled in the art to attach the conductive element to the mask in the device described by Stone and Edelstein because attaching the conductive element to the

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mask would ensure the electrolyte is affected by both the conductive element and the mask to create a more uniform electrolyte and ion flow.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

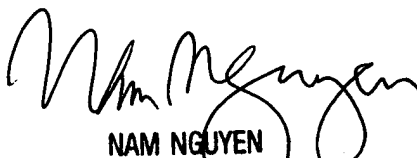
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703) 305-0180. The examiner can normally be reached on Monday-Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone numbers

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for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

blm
April 28, 2003